

REMARKS

Applicants would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe the subject matter which applicant regards as the invention.

Claims 1, 3, 4, 6, and 8-10 are pending in the subject application upon entry of the amendments and the new claims. Claims, 2, 5, and 7 have been canceled without prejudice or disclaimer and to expedite allowance of the application. Claims 8-10 have been added to further describe certain aspects of the invention. Favorable reconsideration in light of the amendments, the new claims, and the remarks which follow is respectfully requested.

Indefiniteness Rejection

Claims 2 and 5 stand rejected under 35 U.S.C. § 112, second paragraph. The cancelation of claims 2 and 5 renders the indefiniteness rejection moot.

Obviousness Rejection of Claims 1 and 7

Claims 1 and 7 stand rejected under 35 U.S.C. §103(a) over Kushiya (US 5981868) in light of Eberspacher (US 5045409) and Basol (US 5028274).

One feature of the claimed invention is that a light absorbing layer is formed by converting a precursor containing an In metal layer and a Cu-Ga alloy layer to the light absorbing layer *via* a first selenization step, a second selenization step, and a third selenization step. At the first selenization step, the precursor is pre-heated in an airtight space at a temperature in a range from a room temperature to 250°C. At the second selenization step, selenium is introduced into the precursor, and In, Cu, and Ga of the precursor are diffused in the precursor at a temperature in a range from 250° to 450°C for 10 minutes to 120 minutes. At the third selenization step, the precursor is recrystallized to form a light absorbing layer at a temperature in a range from 450° to 650°C for 10 minutes to 120 minutes. The third selenization step is performed separately from the second selenization step.

Another feather of the claimed invention is that at the second selenization step,

the supply of hydrogen selenium gas is stopped and the hydrogen selenium gas is discharged through an evacuating step, and then, a fresh hydrogen selenium gas is introduced again.

To this end, claim 1 recites *"a second selenization step of heating an interior of the airtight space to a temperature in a range from 250° to 450 °C, additionally introducing hydrogen selenide gas into the airtight space, **interrupting the supply of hydrogen selenide gas and evacuating the interior of the airtight space followed by reintroducing hydrogen selenide gas into the airtight space for 10 minutes to 120 minutes to introduce selenium into the precursor and diffuses In, Cu, and Ga in the precursor**; a third selenization step of heating an interior of the airtight space to a temperature in a range from 450° to 650 °C, and performing heat treatment of the substrate under the above temperature conditions **using the hydrogen selenide gas reintroduced at the second selenization step for 10 minutes to 120 minutes to recrystallize the precursor to form the light absorbing layer.**"*

The Office action concedes on page 3 that Kushiya fails to teach or suggest selenization conditions as recited in claim 1. The Office action, however, contends on page 3 that Eberspacher teaches such features. From this, the Office action concludes that it would have been obvious to one skilled in the art to have heating the layers according to the method disclosed by Eberspacher in the method of Kushiya to arrive at the claimed invention.

It is respectfully submitted that Eberspacher fails to teach or suggest the claimed selenization conditions. Eberspacher only teaches that a low concentration of H_2Se results in improved device quality. See column 4, lines 29-31 of Eberspacher. Eberspacher, however, fails to teach or suggest specific temperatures for specific periods for the second and third selenization steps, as recited in claim 1.

The Office action contends on page 4 that Basol teaches a deposition sequence of an indium layer and copper-gallium alloy layer. Basol, however, fails to make up for the aforementioned deficiencies of the combination of Kushiya and Eberspacher. As a result, the combination Kushiya, Eberspacher, and Basol fails to teach or suggest all the features of claim 1.

Moreover, the cited art simply fails to teach or suggest interrupting supply of hydrogen selenide gas and evacuating an airtight space followed by reintroducing

hydrogen selenide gas into the airtight space to introduce selenium into the precursor and diffuses In, Cu, and Ga in the precursor, and at the next selenization step, performing heat treatment of the substrate using the hydrogen selenide gas reintroduced at the previous step, as recited in claim 1.

In view of the foregoing, the combination Kushiya, Eberspacher, and Basol fails to teach or suggest all the features of claim 1. Consequently, the cited art cannot render claim 1 obvious. Withdrawal of the rejection is therefore respectfully requested.

Obviousness Rejection of Claim 4

Claim 4 stands rejected under 35 U.S.C. §103(a) over Kushiya, Eberspacher, and Basol in light of Hedstrom (US 5,445,973).

As discussed in the previous section, the combination of Kushiya, Eberspacher, and Basol fails to teach or suggest all the features of claim 1. In particular, the combination fails to teach or suggest the specific temperatures for specific periods for the second and third selenization steps, as recited in claim 1.

Hedstrom is cited in regards to its teaching of a PVD method. Hedstrom, however, contains no teachings regarding the specific temperatures for the specific periods for the second and third selenization steps, as recited in claim 1. As such, Hedstrom fails to cure the aforementioned deficiencies of Kushiya, Eberspacher, and Basol in regards to claim 1. Since claim 4 depends on claim 1, the cited art cannot render claim 4 obvious. Withdrawal of the rejection is therefore respectfully requested.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. KOY-16877.

Respectfully submitted,

RANKIN, HILL & CLARK LLP

By /Kazuto Ishihara/
Kazuto Ishihara, Reg. No. 47675

23755 Lorain Road, Suite 200
North Olmsted, Ohio 44070-2224
(216) 566-9700